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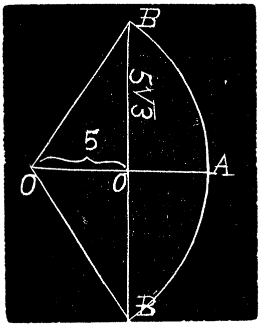
$-\sqrt{(100-y^2)}$ on part of curve in question. Then from conditions of problem



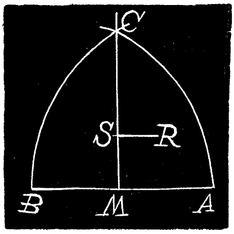
$$V=2\pi\int_0^{5\sqrt{3}}\int_0^{5-\sqrt{(100-y^2)}}x\,dx\,dy=\pi\int_0^{5\sqrt{3}}[125-y^2-10\sqrt{(a^2-y^2)}]dy.$$

$$=\pi\left[125\times5\sqrt{3}-125\sqrt{3}-1000\int_0^{\theta=\sin^{-1}\sqrt{\frac{3}{4}}}\cos^2\theta d\theta\right]$$

$$=\pi\left[125\times4\times\sqrt{3}-1000\left(\frac{\sqrt{3}}{8}+\frac{\pi}{6}\right)\right]=\pi\left[375\sqrt{3}-\frac{1000}{6}\pi\right]=\frac{125\pi}{3}(9\sqrt{3}-4\pi)=395.59+\text{cubic feet.}$$

IV. Solution by W. WIGGINS, Richmond, Indiana.

The volume generated is equal to that of cylinder of base CMA, and altitude equal to the length of the path scolpt out by R, the center of gravity of the area CMA. (Guldins theorem)



Taking B as the origin of co-ordinates and BA as the axis of x, we have for the area of AMC,

$$\text{Area}=\tfrac{1}{2}.100.\frac{\pi}{3}-\tfrac{1}{2}.100.\tfrac{1}{2}.\tfrac{1}{2}\sqrt{3}=\tfrac{1}{6}(100\pi-75\sqrt{3}).$$

If x', y' denote the co-ordinates of c, g, of the area CMA, $x'.\text{ area } CMA=\int_0^{10}x\sqrt{(100-x^2)}dx$.

$x'.\text{ area}=\frac{1}{3}(100-x^2)^{\frac{3}{2}}$ $x'.\text{ area}=\frac{1}{3}y^3$, where $y=5\sqrt{3}$.

$\therefore\ x'=\dfrac{[5\sqrt{3}]^3}{3\times\text{Area}}$, or $x'=\dfrac{125\sqrt{3}}{\text{Area}}$, $\therefore\ SR=\dfrac{125\sqrt{3}}{\text{Area}}-5$. Therefore if h denote the altitude of the equivalent cylinder, we have $h=2\pi\left(\dfrac{125\sqrt{3}}{\text{Area}}-5\right)$.

$$V=2\pi\left(\frac{125\sqrt{3}}{\text{Area}}-5\right)\times\text{Area}=2\pi(125\sqrt{3}-5\text{ Area})=2\pi[125\sqrt{3}-\tfrac{5}{6}(100\pi-75\sqrt{3})]=\frac{125\pi}{3}(9\sqrt{3}-4\pi)=395.59+\text{ cubic feet.}$$

Also variously solved by *C. W. M. BLACK, A. L. FOOTE, J. F. W. SCHEFFER, G. B. M. ZERR, J. H. DRUMMOND, F. P. MATZ, and P. H. PHILBRICK.*

PROBLEMS.

28. Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

How far from the stage must Miss Love sit in order that she *may see to best advantage* Mr. Rich deliver the valedictory oration?

29. Proposed by CHARLES E. MYERS, Canton, Ohio.

A hen running at the rate of $n=2$ feet per second, on the circumference of a circle, radius $r=50$ feet, is observed by a hawk $a=600$ feet directly above the center, The hawk at once starts in pursuit, flying at the rate of $m=5$ feet per second and keeping always in a straight line with the starting point and the hen.

Determine the path followed and the distance the hawk will fly before catching the hen.

MECHANICS.

Conducted by B. F. FINKEL, Kidder, Mo. All contributions to this department should be sent to him.

SOLUTIONS TO PROBLEMS.

11. Proposed by CHARLES E. MYERS, Canton, Ohio.

"A homogeneous sphere moves down a rough inclined plane, whose angle of inclination θ to the horizon is greater than that of the angle of friction; if the coefficient of friction is less than $\frac{2}{7}$ tang. θ, show that the sphere will roll and slide down the inclined plane."

Solution by G. B. M. ZERR, A. M., Principal of High School, Staunton, Virginia.

Let a=the radius of the sphere, ϕ the angle turned through by the sphere.

Resolving along the perpendicular to the inclined plane we have, if mk^2 be the moment of inertia of the sphere about a horizontal diameter, $m\dfrac{d^2x}{dt^2}=mg\sin\theta-F$....(1), where F is friction acting along the plane at the point of contact of the sphere and mg acting vertically at the centre.

Also $m\dfrac{d^2y}{dt^2}=-mg\cos\theta+R$ ....(2), where R is the reaction perpendicular to the plane. In order to avoid reactions let us take moments about the point of contact, and we get $ma\dfrac{d^2x}{dt^2}+mk^2\dfrac{d^2\phi}{dt^2}=mga\sin\theta$....(3).

Since there is no jump, $y=a$....(4).

From (1) $F=\frac{2}{7}\,mg\sin\theta$....(5), from (2) and (4) $R=mg\cos\theta$....(6).

$\therefore$ from (5) and (6) $F=\frac{2}{7}\,R\tan\theta$ but since μ=coefficient of friction $<\frac{2}{7}\tan\theta$, $F=\mu R$ and the equations of motion become $m\dfrac{d^2x}{dt^2}=mg\sin\theta-\mu R$....(7), $0=-mg\cos\theta+R$....(8). $ma\dfrac{d^2x}{dt^2}+mk^2\dfrac{d^2\phi}{dt^2}=mga\sin\theta$....(9).

From (8) $R=mg\cos\theta$, this in (7) gives $\dfrac{d^2x}{dt^2}=g(\sin\theta-\mu\cos\theta)$,

$\therefore$ $x=\frac{1}{2}gt^2(\sin\theta-\mu\cos\theta)$ since the sphere starts from rest. Also $k^2=\frac{2}{5}a^2$.